

Name: _____

Homework 3, due on Mon 17 Feb.

Differentiation with the Quotient Rule

Find the derivative of each function below.

1. (2 pts) $f(x) = \frac{x}{x^2+1}$

$$f'(x) = \frac{(x^2+1)[1] - x[2x]}{(x^2+1)^2} = \frac{1-x^2}{(x^2+1)^2}$$

2. (2 pts) $f(x) = \frac{x}{x^3+x}$

$$f'(x) = \frac{(x^3+x)[1] - x[3x^2+1]}{(x^3+x)^2} = \frac{x^3+x-3x^3-x}{(x^3+x)^2} = \frac{-2x^3}{(x^3+x)^2}$$

$$= \frac{-2x}{(x^2+1)^2}$$

3. (2 pts) $f(x) = \frac{\sin x}{1+\cos x}$

$$f'(x) = \frac{(1+\cos x)[\cos x] - \sin x[-\sin x]}{(1+\cos x)^2} = \frac{\cos x + 1}{(1+\cos x)^2} = \frac{1}{1+\cos x}$$

4. (2 pts) $f(x) = \frac{x+1}{x \sin x}$

$$f'(x) = \frac{(x \sin x)[1] - (x+1)[\sin x + x \cos x]}{(x \sin x)^2} = \frac{-x^2 \cos x - x \cos x - \sin x}{x^2 \sin^2 x}$$

5. (2 pts) $f(x) = \frac{xe^x}{2+e^x}$

$$f'(x) = \frac{(2+e^x)[e^x+xe^x] - xe^x[e^x]}{(2+e^x)^2} = \frac{2e^x + 2xe^x + e^{2x}}{(2+e^x)^2}$$